MEMORANDUM 60/21853.400.03

April 4, 2002

BROWN AND CALDWELL

TO: Tracey T. Piccone, P.E.
Senior Environmental Engineer
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, Florida 33416

FROM: Jim Nissen, Brown and Caldwell

SUBJECT: Contract C-E024
Basin-Specific Feasibility Studies

CC: Gary Goforth, South Florida Water Management District
Tom Emenhiser, HSA Engineers and Scientists
Tom DeBusk, DB Environmental, Inc.
Bob Knight, Wetland Solutions, Inc.
Angela Berry, Brown and Caldwell
Jeremy McBryan, Brown and Caldwell
Emily Mott, Brown and Caldwell

The Brown and Caldwell Team's (BC Team) work to date on the Basin-Specific Feasibility Studies has included peer review of the South Florida Water Management District's (District) Draft Evaluation Methodology (Task 2), peer review of the District's preliminary alternatives for meeting water quality goals in the six Everglades Stormwater Program (ESP) basins, and attendance and participation in various basin workshops and technical review meetings to gain consensus on key issues affecting the conduct of work. The following summarizes the status of work on the various elements of the Basin-Specific Feasibility Studies for the six ESP basins:

1. The methodology for evaluating alternatives has been finalized by the District. The document titled, *Evaluation Methodology for the Water Quality Improvement Strategies for the Everglades* (SFWMD, March 15, 2002) was provided to the BC Team on March 15, 2002.

2. The alternatives for meeting water quality goals in five of the six ESP basins have been finalized by the District in documentation made available to the BC Team on February 27, 2002. The alternatives for the C-11 West Basin were finalized and delivered to the BC Team on March 21, 2002.

3. The District has provided the BC Team with baseline data sets (31-year flows and loads) for each basin, adjusted for total phosphorus (TP) reduction due to source controls. These adjusted baseline data sets will be used in the evaluation of alternatives prior to the time that any Critical Project components or CERP components are implemented.

4. The District has modified the adjusted baseline data set for the C-11 West Basin to reflect the effects that Critical Project components and CERP components will have on the flows and loads requiring treatment. This modified data set will be used in the evaluation of alternatives in future years following the implementation of these components.

5. On March 11 and 12, 2002, a workshop was held at the District's Headquarters to review the current version of the Dynamic Model for Stormwater Treatment Areas (DMSTA), the modeling tool that will be used to evaluate biological treatment alternatives in four of the six ESP basins. As a result of the workshop, further refinements were incorporated into the model. The final version of DMSTA was delivered to the BC Team on March 18, 2002. Minor modifications will continue to be incorporated by Bill Walker as required.

6. The CTSS spreadsheet model developed by HSA remains the most appropriate tool for evaluation of the chemical treatment alternatives proposed in three of the six ESP basins. The BC Team's proposed approach to evaluation of the chemical treatment alternatives is outlined later in this memorandum.

The BC Team is ready to move forward with the evaluation of alternatives as called for in Task 4 of our contract scope of services. However, before we proceed further, we thought it would be beneficial to all involved to make sure that there are no misunderstandings about the direction we are heading. The purpose of this memorandum, therefore, is to summarize our understanding of the alternatives in each basin and our approach to their evaluation within the context of the Evaluation Methodology developed by the District. Presented below are general discussions of our approach to modeling of biological and chemical treatment alternatives, followed by descriptions of the various alternatives in the six ESP basins and the assumptions that we propose to make for the purpose of sizing needed facilities and developing cost estimates.

APPROACH TO EVALUATION OF BIOLOGICAL TREATMENT ALTERNATIVES

The BC Team has received the final version of DMSTA, dated March 15, 2002, that will be used for evaluation of alternatives that include Stormwater Treatment Areas (STA). STAs will be designed to reduce TP to the lowest demonstrated concentration or 10 ppb, whichever is higher, using the optimal combination of emergent vegetation, submerged aquatic vegetation (SAV) and periphyton. In performing DMSTA simulations, the BC Team intends to use the following four calibration data sets presented during the DMSTA Workshop on March 11-12, 2002: Emergent, SAV, PSTA, and NEWS. Table 1 shows a draft summary of the proposed simulations to be performed during the evaluations. For each biological treatment alternative, one STA scenario will be fully evaluated as outlined in *Evaluation Methodology for the Water Quality Improvement Strategies for the Everglades* (SFWMD, March 15, 2002). Reservoirs (for flow equalization) may be included in some simulations to evaluate their effect on TP removal and to assess hydraulic benefits.

Table 1 - Summary of Proposed DMSTA Simulations

Runs	ACME Basin B 71 ppb *	Feeder Canal 50 ppb *	L-28 39 ppb *	C-11 West 22 ppb *
1	Emergent/SAV/PSTA	Emergent/SAV/PSTA	Emergent/SAV/PSTA	Emergent/SAV/PSTA
2	Emergent/NEWS	Emergent/NEWS	Emergent/NEWS	Emergent/NEWS
3	Emergent/PSTA	Emergent/PSTA	Emergent/PSTA	Emergent/PSTA
4	Emergent/SAV	Emergent/SAV	Emergent/SAV	Emergent/SAV
5	SAV/PSTA	SAV/PSTA	SAV/PSTA	SAV/PSTA
6	NEWS	NEWS	NEWS	NEWS
	SAV	SAV	SAV	PSTA
				SAV

***** Basecase flow-weighted mean TP concentrations from SFWMD

The following are assumptions that will be used during the evaluation of biological treatment alternatives with DMSTA.

- DMSTA model simulations do not predict start-up effects (i.e. antecedent soil conditions with high TP concentrations, etc.). The predicted TP outflow concentrations from DMSTA assume steady-state STA operation, however, STAs may not operate at steady-state for several years. The BC Team will develop a scientifically defensible methodology to incorporate the potential delay in TP removal efficiency due to start-up effects for each biological treatment alternative.
- Water depths in an STA will be within the range of calibrated depths to ensure TP removal rates are consistent with the calibrated TP removal rates. Maximum depth in an STA will be 4.5 feet.
- STA vegetation partitioning will be optimized using the base condition inflow TP concentration to maximize TP removal. During subsequent DMSTA simulations, the same vegetation partitioning will be used to conduct sensitivity analyses.
- There will be no increase or decrease in TP concentration as a result of conveyance of stormwater to or from an STA.
- The land gradient is level throughout the STA footprint.
- The STA footprint will be rectangular in shape.
- Inflow seepage will not be evaluated.
- Outflow seepage rate is 0.008 centimeters per day per centimeter of head based on values from the STA-2 DMSTA calibration simulation.
- 50% of the STA seepage water is recycled and returned to the inflow of the cell using a seepage collection system. 50% will be assumed to be lost to groundwater.
- Seepage water TP concentration is equal to the STA water column TP concentration up to a maximum of 20 ppb.
- Rainfall time series data provided by the District will not be incorporated into DMSTA as rainfall within the basin is already included in the baseline flows and loads.
- Reference Evapotranspiration (ET) data provided by the District will be incorporated into DMSTA. No adjustments to the reference ET will be performed as the actual ET for treatment wetlands equals reference ET. (*Treatment Wetlands*, Kadlec & Knight, 1996)
- Current flood protection within the basin will be maintained.
- There will be no reduction in the baseline flows associated with an STA.

- A sensitivity analysis of key DMSTA parameters will be performed. Potential parameters to be assessed are as follows: seepage rate, numbers of tanks in series (TIS), reservoirs, rain TP concentration, seepage treatment through levees, and seepage recycle percentage, etc.

APPROACH TO EVALUATION OF CHEMICAL TREATMENT ALTERNATIVES

The BC Team will develop a full-scale chemical treatment facility scenario for application in Wellington / ACME Basin B, the C-11 West Basin, and the North New River Canal Basin. A spreadsheet water balance program will use daily flow and TP concentration data from the 31-year period of record to determine treatment plant and flow equalization basin (FEB) sizes to achieve a long-term (31-year) geometric mean phosphorus concentration of 10 ppb.

The chemical treatment technology has demonstrated via pilot testing the capability to achieve 6 ppb TP in the treated effluent. Accordingly, blending of treated effluent with untreated feed water will be considered in order to produce a combined effluent concentration of 10 ppb. For this analysis, the chemical treatment system technology coupled with metal salt coagulant addition will produce an average clarified effluent TP concentration of 6 ppb at average flow and 10 ppb at peak flow. A blending basin with a 3-day hydraulic retention time will be included to allow mixing of treated and un-treated waters prior to discharge to a receiving water body.

A sensitivity analysis will be conducted to test the impact on FEB size and treatment plant capacity assuming an average clarified effluent TP concentration of 8 ppb at average flow and 13 ppb at peak flow.

Two residuals management options will be considered: (1) disposal to a dedicated land application site and (2) dewatering via centrifuge or filter press and hauling of dewatered cake to a local landfill for disposal. After an initial screening, the most attractive method for residual solids disposal will be included in the evaluation for each alternative.

The following are assumptions that will be used during the evaluation of chemical treatment alternatives:

- The FEB will not provide phosphorus removal.
- Rainfall to and ET from the FEB will be disregarded.
- The side water depth in the FEB will be maintained from a minimum of 0.5 feet to a maximum of 7.0 feet.
- The full-scale chemical treatment system can operate at a peak load (50 percent greater than its average daily design flow rate) for limited time periods.
- Outflow seepage from the equalization basin will be handled in a similar manner to the biological options.
- The land gradient throughout the equalization basin footprint is level.
- Seepage water concentration will be assumed to be equal to the equalization basin TP concentration up to a maximum of 20 ppb.

ALTERNATIVE WATER QUALITY COMBINATIONS FOR WELLINGTON / ACME BASIN B

The following section describes the BC Team's understanding of the final alternative water quality combinations for Wellington/ACME Basin B:

Alternative 1 - Implement Best Management Practices (BMPs) by 2006 and Divert ACME Basin B Runoff to the CERP Agricultural Reserve Reservoir in 2013

Alternative 1 includes construction of pump station(s) and canal(s) to direct ACME Basin B runoff to the Agricultural Reserve Reservoir CERP project (CERP Component VV). These improvements would be constructed in conjunction with the CERP project in 2013. Prior to 2013, the baseline flows to the Refuge would continue. After the diversion components are constructed and the Reservoir comes on line in 2013, all flows and TP loads from ACME Basin B will be diverted to the Reservoir.

This alternative would require land acquisition for construction of a diversion canal and at least one pump station. The recommended location of the diversion pump station will be at the southeast end of ACME Basin B at the intersection of at least three ACME canal segments to provide operational flexibility. The diversion canal will be located directly east and adjacent of the Strazzula Wetlands for the majority of the canal reach. In addition, the diversion canal will connect directly to the Agricultural Reserve Reservoir without mixing with waters in the LWDD system. To accomplish this, it is assumed that a siphon will be constructed to allow the diversion canal to cross the LWDD L-23W canal without mixing. A second pump station may be required at the downstream end of the diversion canal to lift water into the Reservoir.

The base case for Alternative 1 will assume a 25% reduction in baseline TP loads. This equates to a 25% reduction in TP concentrations as it is assumed that there will be no change in the baseline flows associated with source controls. As part of a sensitivity analysis, two sets of load reduction and concentration calculations will be performed. The first will use the original baseline TP concentrations associated with discharges to the Refuge from ACME Basin B. The second will use concentrations with a 50% reduction resulting from the implementation of source controls. The influence that these concentrations have on TP loads to the Refuge will be calculated and summarized.

Assumptions:

- Stormwater BMPs, as defined by the ESP, will be implemented in the basin by December 31, 2006.
- Control elevation of ACME Basin B canals is assumed to be 12 feet NGVD (currently at 13 feet NGVD; the permit is being modified).
- Current flood protection within the basin will be maintained.
- As instructed by the District, the CERP Impoundment previously planned for Section 34 will not be included in the analysis.

- The diversion pump station and canal will accommodate a maximum design flow of 505 cfs. The pump station will have 100 percent redundancy and the canal will have 12 inches minimum freeboard at design flow.
- ACME Pump Stations 1 and 2 will remain in place for emergency back-up, but will be taken out of regular service after the diversion project is complete in 2013.
- The diversion canal will be designed using a seasonal high groundwater level to be determined. No site-specific surficial groundwater levels are available from the District or USGS. Seepage and groundwater interactions will not be considered in the analysis.
- The Agricultural Reserve Reservoir design depth is assumed to be 12 feet above grade based on current CERP documentation. Current grade within the reservoir footprint is approximately 15 feet NGVD (based on SFWMD topographic data). Thus, the surface water design elevation is assumed to be 27 feet NGVD**.**
- The Agricultural Reserve Reservoir has adequate capacity to accept the ACME Basin B runoff.

Alternative 2 - Implement Best Management Practices (BMPs) and Construct a Chemical Treatment Facility on 375 Acres Currently Owned by the District by 2006

Alternative 2 includes construction of a chemical treatment facility, to be located on the 375 acres of Section 24 owned by the District, by December 31, 2006. Stormwater runoff from ACME Basin B would be pumped into a flow equalization basin and then treated in the chemical treatment facility. Treated effluent would be discharged into a shallow linear retention area located between Wellington's C-27 canal and the L-40 levee prior to being pumped into the Refuge using the two existing ACME pump stations.

The base case for Alternative 1 will assume a 25% reduction in baseline TP loads. This equates to a 25% reduction in TP concentrations as it is assumed that there will be no change in the baseline flows associated with source controls.

Alternative 3 - Implement Best Management Practices (BMPs) and Construct an STA on 375 Acres Currently Owned by the District by 2006

Alternative 3 includes construction of an STA, on the 375 acres of Section 24 owned by the District, by December 31, 2006. The STA will be designed to reduce TP to the lowest demonstrated concentration or 10 ppb, whichever is higher, using the optimal combination of emergent vegetation, SAV and periphyton.

An inflow pump station would be constructed at the northwest corner of the basin to pump stormwater runoff from the basin into the STA. Expansion or modification of ACME canals to provide adequate capacity or to maintain the current level of flood protection within the basin may also be necessary. After stormwater passes through the STA, a new canal will be used to convey the treated stormwater to the two existing ACME pump stations. The ACME pump stations will pump treated stormwater into the Refuge.

The base case for Alternative 1 will assume a 25% reduction in baseline TP loads. This equates to a 25% reduction in TP concentrations as it is assumed that there will be no change in the baseline flows associated with source controls. As part of a sensitivity analysis, two sets of load reduction and

concentration calculations will be performed. The first will use the original baseline TP concentrations associated with discharges to the Refuge from ACME Basin B. The second will use concentrations with a 50% reduction. The influence that these reductions have on the STA's outflow TP concentration will be calculated and summarized. As part of this evaluation, the degree of source control required to achieve the lowest demonstrated TP concentration or 10 ppb, whichever is higher, with the 375-acre STA will also be calculated.

Alternative 4 - Implement Best Management Practices (BMPs) and Construct an STA by 2006

Alternative 4 includes construction of an STA by December 31, 2006. This alternative is similar to Alternative 3, however the size of the STA is not constrained to 375 acres. Discharges from the STA would be directed to the Refuge by December 31, 2006. The STA will be designed to reduce TP to the lowest demonstrated concentration or 10 ppb, whichever is higher, using the optimal combination of emergent vegetation, SAV and periphyton. A location for the STA will not be recommended. Only the acreage required for construction of the proposed STA will be determined.

Expansion or modification of ACME canals to provide adequate capacity or to maintain the current level of flood protection within the basin may also be necessary. After stormwater passes through the STA, a new canal will be used to convey the treated stormwater to the two existing ACME pump stations. The ACME pump stations will pump treated stormwater into the Refuge.

The base case for Alternative 1 will assume a 25% reduction in baseline TP loads. This equates to a 25% reduction in TP concentrations as it is assumed that there will be no change in the baseline flows associated with source controls. As part of a sensitivity analysis, two sets of load reduction and concentration calculations will be performed. The first will use the original baseline TP concentrations associated with discharges to the Refuge from ACME Basin B. The second will use concentrations with a 50% reduction. The influence that these variations have on the size of the STA will be calculated and summarized.

ALTERNATIVE WATER QUALITY COMBINATIONS FOR THE NORTH NEW RIVER CANAL BASIN

The following section describes the BC Team's understanding of the final alternative water quality combinations for the North New River Canal (NNRC) Basin:

Alternative 1 - Implement Best Management Practices (BMPs) and Construct Basin Level Chemical Treatment by 2006 until Implementation of CERP Component in 2018

Alternative 1 includes construction of a chemical treatment facility within the NNRC Basin by December 31, 2006. A small surface water storage area upstream of the chemical treatment facility should be sufficient, since the G-123 pump station is intended to be used primarily for water supply to WCA-3A and seepage return, not for flood control. Stormwater BMPs, as defined by the ESP, will be implemented in the basin by December 31, 2006.

The CERP component includes construction of a divide structure across the NNRC near Markham Park by 2018. New canals will also be constructed to convey stormwater from the existing Bonaventure pump stations on the south side of the NNRC to the east side of the proposed divide structure. This project would eliminate all stormwater runoff from the NNRC Basin to the G-123 pump station by 2018.

Assumptions:

- There will be no change in the baseline flows associated with source controls.
- A source control sensitivity analysis will not be performed for this alternative.
- The chemical treatment facility will be sized using the G-123 flows and loads.
- Since the G-123 pump station operation is dependent upon the levels in the Water Conservation Areas, which are not affected by Alternative 1, there will be little if any effect of Alternative 1 on the flows through G-123 to the Everglades Protection Area (EPA). Therefore, it is assumed that the chemical treatment plant will have no effect on the baseline flows.
- After the CERP project is implemented in 2018, the chemical treatment plant will no longer be needed as only seepage water will enter the EPA.
- Seepage TP concentration from WCA-2B is assumed to be 10 ppb.

Alternative 2 - Discontinue use of G-123 Pump Station and Implement Best Management Practices (BMPs) by 2006 until Implementation of CERP Component in 2018

In Alternative 2, the use of the G-123 pump station would cease until implementation of the CERP component in 2018. Thus, all seepage from WCA-2B and flows from the developed areas of the NNRC Basin would be diverted away from the EPA and conveyed east through the G-54 Structure from 2006 to 2018. Upon completion of the CERP component, G-123 will only pump seepage water to WCA-3. Stormwater BMPs, as defined by the ESP, will be implemented in the basin by December 31, 2006.

The CERP component includes construction of a divide structure across the NNRC near Markham Park by 2018. New canals will also be constructed to convey stormwater from the existing Bonaventure pump stations on the south side of the NNRC to the east side of the proposed divide structure.

Assumptions:

- There will be no change in the baseline flows associated with source controls.
- A source control sensitivity analysis will not be performed for this alternative.
- No additional costs are associated with this alternative.
- Seepage TP concentration from WCA-2B is assumed to be 10 ppb.

Alternative 3 - Implement Best Management Practices (BMPs) by 2006 until Implementation of the CERP Project Basin Divide in 2018

Alternative 3 eliminates flows and loads to the G-123 pump station after the CERP component is constructed in 2018. Prior to the CERP project coming on line, the inflows through the G-123

pump station will remain the same as under current conditions. Stormwater BMPs, as defined by the ESP, will be implemented in the basin by December 31, 2006.

As part of a sensitivity analysis, the phosphorus load associated with discharges to the EPA from the NNRC Basin from 2006 to 2018 will be reduced by 25%. The influence that this reduction has on the outflow phosphorus concentration and load will be calculated and summarized.

Assumptions:

- There will be no change in the baseline flows associated with source controls.
- No additional costs are associated with this alternative.
- Seepage TP concentration from WCA-2B is assumed to be 10 ppb.

ALTERNATIVE WATER QUALITY COMBINATIONS FOR THE NORTH SPRINGS IMPROVEMENT DISTRICT BASIN

The following section describes the BC Team's understanding of the final alternative water quality combinations for the North Springs Improvement District (NSID) Basin:

Alternative 1 - Implement a Source Control Component and a Diversion Component by 2006 until the CERP Component is Implemented in 2007

Alternative 1 involves a temporary diversion of stormwater to the Bishop property rock pits on the north side of NSID by December 31, 2006 (using temporary pumps/structures). This diversion would serve as a solution for one year until the CERP component (Hillsboro Impoundment - Site 1) is complete in 2007. All flows from NSID will be diverted to the CERP component via the L-36N and/or a new canal and diverted to the Hillsboro Impoundment starting in 2007. This alternative assumes that up to 100% of the basin's discharges would be diverted away from the EPA by relying on a temporary diversion and a CERP component. Stormwater BMPs, as defined by the ESP, will be implemented in the basin by December 31, 2006.

Assumptions:

- There will be no change in the baseline flows associated with source controls.
- A source control sensitivity analysis will not be performed for this alternative.
- The basin flows that previously went to the EPA, will be used to size the diversion components (structures, pumps, etc.).

Alternative 2 - Implement a Source Control Component with a Diversion Component by 2006

Alternative 2 is a diversion that would serve as a permanent solution. This alternative assumes that 100% of the basin's discharges would be diverted away from the EPA. This alternative could provide additional surface storage in lakes or an impoundment within or adjacent to the basin, such as the Bishop property rock pit to the north of NSID. Alternative 2 listed several diversion options in Appendix A of *Alternative Combinations for the North Springs Improvement District Basin* (SFWMD,

February 27, 2002). All of these options will be initially screened and only one option will be fully evaluated. Stormwater BMPs, as defined by the ESP, will be implemented in the basin by December 31, 2006.

Assumptions:

- There will be no change in the baseline flows associated with source controls.
- A source control sensitivity analysis will not be performed for this alternative.
- The basin flows that previously went to the EPA, will be used to size the diversion components (structures, pumps, etc.).

Alternative 3 - Implement a Source Control Component by 2006 until Implementation of the CERP Component in 2007

Alternative involves implementation of a source control component by 2006. Prior to the CERP project coming on line, this basin's discharges to the EPA would continue. Upon completion of the CERP component, all runoff from this basin would be diverted to the Hillsboro Impoundment to the north. Therefore, the CERP component will eliminate all loads discharged from this basin to the EPA after 2007. Stormwater BMPs, as defined by the ESP, will be implemented in the basin by December 31, 2006.

As part of a sensitivity analysis, the phosphorus load associated with discharges to the EPA from the NSID Basin will be reduced by 25%. The influence that this reduction has on the outflow phosphorus concentration and loads to the EPA will be calculated and summarized.

Assumptions:

- There will be no change in the baseline flows associated with source controls.
- No additional costs are associated with this alternative.

ALTERNATIVE WATER QUALITY COMBINATIONS FOR THE FEEDER CANAL BASIN

The following section describes the BC Team's understanding of the final alternative water quality combinations for the Feeder Canal Basin:

Alternative 1 - Implement Source Control Component by 2006 and STA Component by 2006

Alternative 1 involves construction of an STA in the Feeder Canal Basin to treat stormwater flows prior to discharge to WCA-3A for the period December 2006 through 2056. The STA will be designed to reduce TP to the lowest demonstrated concentration, or 10 ppb, whichever is higher, using the optimal combination of emergent vegetation, SAV and periphyton. A location for the STA will not be recommended. Only the acreage required for construction of the proposed STA will be determined.

This alternative also incorporates a source control component to reflect the potential phosphorus load reductions by relying on existing and planned activities within the Feeder Canal Basin. These activities include agricultural stormwater BMPs as defined by the ESP (or on Indian Lands under the authority of the EPA), along with enforcement of any applicable permit conditions such as the McDaniel Ranch surface water management master permit.

As part of a sensitivity analysis, the phosphorus loads associated with discharges from the Feeder Canal Basin will be varied to 75 ppb and 100 ppb, and the influence that this variation has on the size of the STA will be calculated and summarized. An additional 50-year present worth cost estimate will be developed for the 75 ppb sensitivity analysis case described above.

Assumptions:

- The baseline loads were reduced by the District to reflect 50 ppb discharges from the Feeder Canal Basin as a whole for the full evaluation of this alternative. It is assumed that there will be no change in the baseline flows associated with source controls.
- The effects of CERP components in the Feeder Canal Basin will not be considered in sizing the STA. The District did not provide the adjusted baseline flows to the BC Team due to the boundary conditions used in the South Florida Water Management Model.
- In addition, a separable cost will be determined for operation of the STA from 2015 to 2056.

Alternative 2 - Implement Source Control Component by 2006

This alternative incorporates a source control component by December 31, 2006 to reflect the potential phosphorus load reductions by relying on existing and planned activities within the Feeder Canal Basin. These activities include agricultural stormwater BMPs as defined by the ESP (or on Indian Lands under the authority of the EPA), along with enforcement of any applicable permit conditions such as the McDaniel Ranch surface water management master permit.

As part of a sensitivity analysis, the phosphorus loads associated with discharges from the Feeder Canal Basin will be varied to 75 ppb and 100 ppb, and the influence that this variation has on the loads to WCA-3A will be calculated and summarized.

Assumptions:

- The baseline loads were reduced by the District to reflect 50 ppb discharges from the Feeder Canal Basin as a whole for the full evaluation of this alternative. It is assumed that there will be no change in the baseline flows associated with source controls.

ALTERNATIVE WATER QUALITY COMBINATIONS FOR THE L-28 BASIN

The following section describes the BC Team's understanding of the final alternative water quality combinations for the L-28 Basin:

Alternative 1 - Implement Source Control Component by 2006 and STA Component by 2006

Alternative 1 involves construction of an STA in the L-28 Basin to treat stormwater flows prior to discharge to WCA-3A for the period December 2006 through 2056. The STA will be designed to reduce TP to the lowest demonstrated concentration, or 10 ppb, whichever is higher, using the optimal combination of emergent vegetation, SAV and periphyton. A location for the STA will not be recommended. Only the acreage required for construction of the proposed STA will be determined.

This alternative also incorporates a source control component to reflect the potential phosphorus load reductions by relying on existing and planned activities within the Feeder Canal Basin. These activities include agricultural stormwater BMPs as defined by the ESP (or on Indian Lands under the authority of the EPA), along with enforcement of any applicable permit conditions.

As part of a sensitivity analysis, the phosphorus loads associated with discharges from the L-28 Basin will be reduced by 25% and the influence that this variation has on the size of the STA will be calculated and summarized. An additional 50-year present worth cost estimate will be developed for this case.

Assumptions:

- The baseline flows and loads for the L-28 Basin will be used for the full evaluation of this alternative. It is assumed that there will be no change in the baseline flows associated with source controls.
- CERP Components do not directly affect the activities in Alternative 1. The flows from the CERP components will not enter the L-28 borrow canal, as the water from these areas will already have been treated to a phosphorous concentration of 10 ppb.
- The STA will be sited adjacent to the L-28 borrow canal. The L-28 borrow canal will serve as the source water and discharge site for the STA. Conveyance of water from the L-28 borrow canal to the STA will be through a new pump station. It is assumed that no additional canals will be constructed.

Alternative 2 - Implement Source Control Component by 2006

This alternative incorporates a source control component by December 31, 2006 to reflect the potential phosphorus load reductions by relying on existing and planned activities within the L-28 Basin. These activities include agricultural stormwater BMPs as defined by the ESP (or on Indian Lands under the authority of the EPA), along with enforcement of any applicable permit conditions.

As part of a sensitivity analysis, the phosphorus loads associated with discharges from the L-28 Basin will be reduced by 25% and the influence that this variation has on the loads to WCA-3A will be calculated and summarized.

Assumptions:

- The baseline flows and loads for the L-28 Basin will be used for the full evaluation of this alternative. It is assumed that there will be no change in the baseline flows associated with source controls.

ALTERNATIVE WATER QUALITY COMBINATIONS FOR THE C-11 WEST BASIN

The following section describes the BC Team's understanding of the final alternative water quality combinations for the C-11 West Basin:

General Assumptions:

- Seepage and stormwater flows and loads from the C-11 West Basin entering WCA-3A will be impacted in phases by implementation of Critical and CERP projects during the evaluation period. The flows and loads coming from the C-11 West Basin following implementation of these projects have been estimated by the District and are summarized in the table below. The BC Team will assume reduced stormwater flows to WCA-3A after January 2006 according to the estimates prepared by the District.

Flow Component	January 2006 - January 2036			January 2036 - January 2056		
	Average Annual Flow (ac-ft) (Simulated)	Average Annual Phosphorus Concentration (ppb)	Average Annual Phosphorus Loads (kg) (Simulated)	Average Annual Flow (ac-ft) (Simulated)	Average Annual Phosphorus Concentration (ppb)	Average Annual Phosphorus Loads (kg) (Simulated)
C-11 West Stormwater Runoff	18,283	22	493	885	28	31

- The SFWMD Governing Board has passed a resolution to comply with state water quality standards in the C-11 West Basin by December 31, 2005 due to legal action by stakeholders. The BC Team's evaluation will only address flows as calculated from January 2006 through June 2036 and June 2036 through December 2055.
- It is assumed that the S-9A pump station will pump seepage flows exclusively after December 2002. Seepage flows from WCA-3 were removed from the baseline flows and loads by the District and will not be addressed, either in flow/load calculations or for treatment facilities.
- Stormwater will be diverted to WCA-3A through the existing S-9 pump station. It is assumed that the S-9 pump station will pump stormwater flows exclusively after December 2002.

Alternative 1 - Implement Source Control Component and Chemical Treatment Component by December 2005. Implementation of Western C-11 Impoundment and Diversion Canal CERP Project in January 2006 and Implementation of North Lake Belt Storage Area CERP Project in June 2036.

The chemical treatment facility will require land acquisition and construction of the facility by December 2005. The chemical treatment facility will treat stormwater (S-9) flows only. Two stormwater flow regimes will be evaluated for this alternative, one covering the period of January

2006 through June 2036 and the other covering the period June 2036 through December 2055. The chemical treatment facility will be conceptually sized in modules to accommodate downsizing for the significantly lower anticipated stormwater flows after completion of the 2036 CERP Project. Closing of the S-381 structure will serve as the "plug" in the C-11 West Canal to achieve diversion of all the stormwater flow from the basin to the chemical treatment facility.

Alternative 2 - Implement Source Control Component and STA by December 2005, Implementation of Western C-11 Impoundment and Diversion Canal CERP Project in January 2006 and Implementation of North Lake Belt Storage Area CERP Project in June 2036.

This alternative will require land acquisition and construction of an STA by December 2005. Ancillary facilities to the STA will include a pump station/structure located upstream of S-381 to divert all of the C-11 West stormwater into the STA. A return structure will deliver treated water from the STA to the C-11 West Canal downstream of S-381. S-381 will be closed and will serve as the "plug" in the C-11 West Canal to achieve diversion of all the stormwater flow from the basin to the STA. The STA will treat stormwater (S-9) flows only. Two stormwater flow regimes will be evaluated for this alternative. One covering the period of January 2006 through June 2036 and the other covering the period June 2036 through December 2055.

The STA will be designed to reduce TP to the lowest demonstrated concentration, or 10 ppb, whichever is higher, using the optimal combination of emergent vegetation, SAV and periphyton. The STA will be conceptually sized in cells to accommodate downsizing for the significantly lower anticipated stormwater flows after completion of the 2036 CERP Project. A location for the STA will not be recommended. Only the acreage required for construction of the proposed STA will be determined.

Alternative 3 - Implement Source Control Component by December 2005. Implementation of Western C-11 Impoundment and Diversion Canal CERP Project in January 2006 and Implementation of North Lake Belt Storage Area CERP Project in June 2036.

This alternative will not require any land acquisition or construction of new facilities. Essentially, stormwater flows will be diverted to CERP Impoundments or storage facilities as those new facilities come on line in January 2006 and June 2036. Following implementation of the 2036 CERP component, the stormwater flows that reach S-9 will do so only after no more diversion capacity is available at the Western C-11 or C-9 Impoundments, or the North Lake Belt Storage Area. It is anticipated that a small portion of the stormwater flow (average of 885 acre-feet/year), which will not be captured in the above CERP components, will remain and will be discharged out of the C-11 West Canal through the S-381 and S-9 structures to WCA-3A without any treatment.